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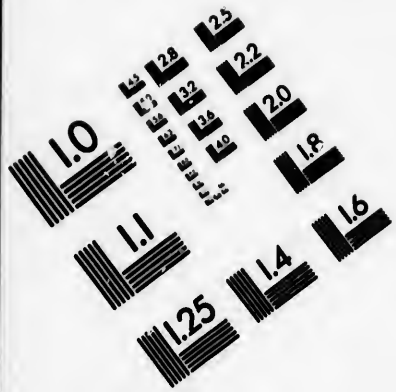

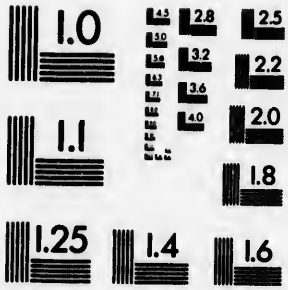

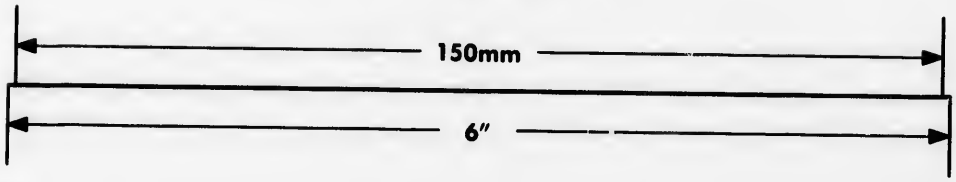

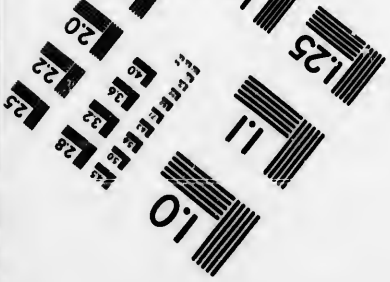

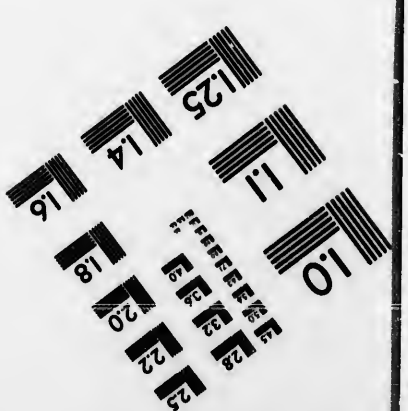

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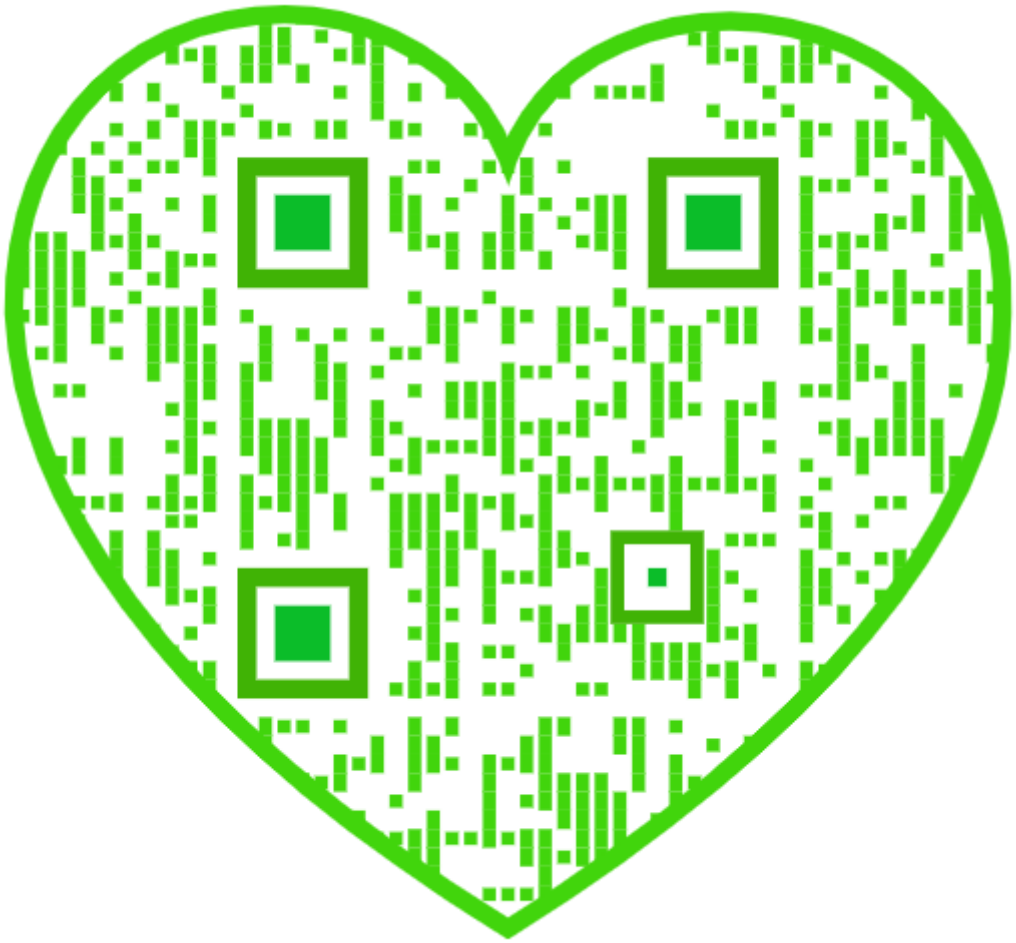

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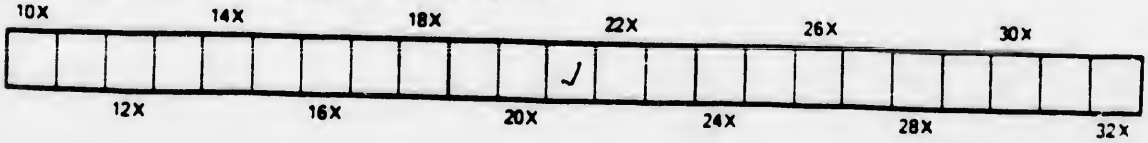

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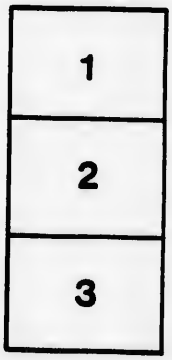

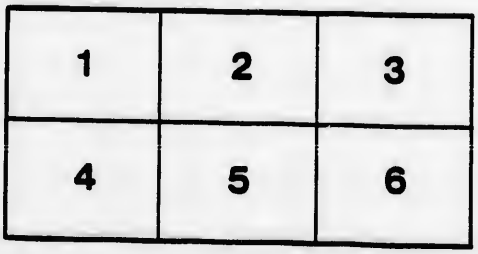

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ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXV.

BUTTER-MAKING ON THE FARM IN SUMMER

BULLETIN LXXVI.

BUTTER-FAT IN MILK AND CREAM.

BY H. H. DEAN, B.S.A., PROFESSOR OF DAIRY HUSBANDRY.

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BULLETIN LXXV.

BUTTER-MAKING ON THE FARM IN SUMMER.

Many enquiries have recently been received by this department as to printed matter dealing with butter-making, which shows that there is a desire for something of that nature. To aid the over-worked farmers' wives and daughters in the difficulties which constantly arise in the handling and care of milk and cream, and also in the churning of the butter, we thought that we could not do better than to give a simple outline of how our dairy at Guelph is managed in the summer time. We might here say, however, that we think it would be far better for our butter-making industry if the manufacture of the butter were done more largely in creameries or factories as in the case of cheese. The chief advantages of such a system are, a more uniformly good quality of produce and a lessening of labor at the farm.

Our dairy herd at the present time numbers fourteen cows, twelve of which are now giving milk. We are raising eight calves, which are fed chiefly on warm sweet skim-milk containing a little oil cake. Each calf has a small box in which dry oatmeal and oil cake are placed, and which they soon learn to eat with a relish. Some cut grass fed in the stable completes their ration.

IN THE STABLE. At present the cows are at pasture. Night and morning they are brought into the stable to be milked, and are fed a small quantity of bran—about one pound a day. At the side of each manger is a small box, which is kept full of salt, and in front of each animal is a water trough, where they may obtain drink at will. Before commencing to milk the *men* wash their hands, for which purpose we keep a wash basin, soap and towel in the stable. Milking begins at five o'clock morning and evening. Each cow's udder is well brushed before commencing to milk, and the milking is done as quickly and quietly as possible. As soon as the cow is milked her milk is weighed, and the weight recorded on a sheet. (Twice a week, morning and evening, each cow's milk is tested for the per cent. of fat or butter in her milk.) The milk is then strained into shot gun cans through a gauze strainer having three or four thicknesses of butter cloth fastened on the underside by means of a tin ring, which slips over the rim on the bottom of the strainer, thus securely fastening the cloth, and making an almost perfect strainer. The milk is removed from the stable to the dairy as quickly as possible after it is milked, and again strained before it is run through the cream

separator. When all the cows are milked they are taken to the pasture. The stable is thoroughly cleaned out after each milking and the floor sprinkled with land plaster, the windows and doors being kept open as much as possible to give the stable a good airing.

Later in the season when the pastures begin to dry up we shall feed to each cow *in the stable* from twenty to thirty pounds a day of green peas and oats, of which we have about three-quarters of an acre growing vigorously at the present time. Later we shall feed about the same quantity of green tares and oats, of which we have about an acre and a-quarter, sown ten or twelve days after the peas and oats. Later still we shall feed green corn, of which we have about two acres. We are thus prepared for a dry season if it comes, and if we do not require these to feed in summer they will be cured and kept for the winter.

In the Dairy. We have been using a Laval "Baby" separator, No. 2 (hand power), for over a year, and like it very much. Recently we have purchased an Alexandra No. 8, and although we have not yet used it a similar machine has been in use at the Farm for some time, and is giving good satisfaction. It is a cheaper machine than the Laval. Our method of using is as follows: After the speed of the bowl has been attained the tap is opened from the supply can, and the warm milk allowed to flow into the machine. *It is very important to attain the normal speed of the machine before allowing any milk to flow into the bowl.* Some have had trouble from lack of care in this particular. When the last of the whole milk is out of the supply can we run about a gallon of skim-milk through, and lastly about the same amount of warm water, to clean the cream out of the bowl. The cream is then cooled down to about 45° Fahrenheit, the machine and all utensils thoroughly washed, and the dairy made neat and tidy—as every dairy should be. The skim-milk is then taken back to the stable for the calves, and the cream put into the cream pail and kept cool until twenty-four hours before we wish to churn. (I may say that I think a preferable plan would be to have a neat, clean room in or near the stable, where the separator might be set, and when separated the cream could be taken to the dairy or cellar, while the skim-milk would be where it is wanted for feeding.) The cream is kept in one large (ten gallon) tin can, which has a *tin* spoon in it for stirring at every addition of fresh cream, and also for stirring when the cream is either cooled or warmed.

Sometimes the milk is set in deep cans or creamers, in cold or ice water. When this is done the milk is put in the cans while warm, and cooled to at least 45° Fahrenheit before skimming, which is usually done at the end of twelve hours. After skimming the cream is handled in the same way as from the separator, except that it is not cooled, it being already cold enough.

Those who still use the small shallow pan should set where the air is pure, the temperature even (fifty to sixty degrees), and skim always before the milk becomes thick. Do not be afraid to take off some skim-milk along with the cream.

CHURNING. We churn three times a week—Monday, Wednesday and Saturday. The night before we churn the cream is warmed to about 65° by setting the cream can in another vessel containing water at about 90° to 100°. We use a large can, but a washtub will answer the purpose very well. The cream is kept stirred until it gets to the proper temperature, when it is either placed in a "Boyd Ripening Vat," or set in a room where the temperature is about the same as the cream. The next afternoon the churning is done, but when the weather becomes very warm we shall churn in the morning while it is cool. The cream will also be set to ripen earlier if necessary. This matter of ripening or souring of the cream is a very important one in preparing butter for the present market, and to get a profitable yield of butter. The only rule that I can give at present as to when the cream is ripe or sour enough is that as soon as it gets about as thick as good maple syrup, tastes slightly sour, and has begun to separate into small particles it is ready to churn, and we then churn it without allowing it to stand any longer.

Our average temperature for churning during summer is 58°—ranging one or two degrees higher or lower according to circumstances. The cream is brought to this temperature in a manner similar to preparing it for ripening; it is then weighed and strained through a perforated tin strainer into the churn. The cream can is then rinsed out with a little water. For every ten pounds of cream we add one dram (about half a teaspoonful) of Hansen's or Yorkshire butter color. This is done before starting the churn, and for the purpose of imparting a "June grass color" to the butter.

The churn we use is a No. 5 "Daisy." Two or three times during the first ten minutes of churning the plug at the bottom is removed to allow the gas to escape. Churning usually occupies from fifteen to twenty minutes—seldom over half an hour. The churn revolves at the rate of sixty or seventy turns to the minute. As soon as the butter "breaks," which we can tell by the swishing sound, or by the clearing of the glass in the cover, we add a quart or two of water for each pailful of cream, the temperature of the water varying with the day and the condition of the cream. On a warm day one can scarcely have the water too cold, as it will then chill the particles of butter and make them firm, while at the same time the water dilutes the buttermilk, allowing a more perfect separation of the butter. The churning then continues until the butter granules are about the size of grains of wheat or a little smaller, when the churn is stopped, the buttermilk drawn off from below and

strained through the strainer previously mentioned for the cream. This strainer serves to catch any particles of butter which may come out with the buttermilk; but if the separation has been complete the butter will float on the top and none appear in the buttermilk until the very last. We next add cold water or weak brine in quantity sufficient to float the butter and wash out the butter-milk. We usually half fill the churn with water, give it a few rapid turns, and draw off the milky water. The operation is repeated with pure cold water, which generally comes away clear. If it is not clear, water is added the third time. The butter is then allowed to drain in the churn for fifteen minutes or half an hour, and sometimes the salt is added while still in the churn; but as a rule the butter is removed from the churn, placed in a butter-tub and weighed. It is then spread upon a V shaped worker that slants towards the front and has a lever fastened at the lower end. Fine salt at the rate of one ounce for each pound of butter as it comes from the churn is now sifted on by means of a hair sieve. After sifting on about half of it the butter and salt are gently stirred, when the rest of the salt is added, and the butter worked by means of the lever. We work sufficiently to remove the excess of water, to thoroughly incorporate the salt in every particle of butter, thus preventing "streaks," and making a firm, compact body. The butter is then put up in pound prints made by means of Carver's butter mould, or a mould made by Moyer & Son, Toronto. These may be gauged so as to print a pound quite accurately, and their use saves a great deal of labor. Each print is then wrapped in parchment butter paper—one sheet wrapping a pound. On these sheets is printed, in such a way that when folded the words appear on the top of each block, the following, which serves as an advertisement:

FRESH BUTTER

MADE AND PUT UP BY THE

EXPERIMENTAL DAIRY,

GUELPH.

We never had enough at one churning to make a shipment, so the blocks of butter are put in the box. This box is made of wood, containing four *wooden* trays, with an opening down the centre in which is placed a tin vessel filled with ice, and the whole is kept in a cool room until the box is full, when it is taken to a commission merchant in the city of Guelph.

There are perhaps fifty ways of making good butter, and I do not claim that ours is the best. There are scarcely two persons that pursue exactly the same method in all the details, but I

think the plan here outlined will, if carried out in any dairy, give butter that no one need be ashamed to have a buyer examine.

THINGS WE DO NOT DO.

1. We do not consider that we know everything about butter-making, as something new is being discovered every month. Not only from our own work are we continually learning, but also from the observation and research of others.

2. We do not keep a cow that makes less than 200 pounds of butter in a year;

3. Nor put the dry cow on a starvation ration;

4. Nor expect a cow to make something out of nothing;

5. Nor keep our cows in an ice-house, hog-pen or dungeon;

6. Nor allow them to go a whole year without carding or brushing them.

7. Nor depend upon pasture alone for a supply of summer feed.

8. We do not allow the milk to stand very long in the stable to absorb foul odors.

9. We do not neglect to strain the milk at once after milking;

10. Nor set the milk in deep cans in well water without changing the water at least twice, or without ice;

11. Nor mix sweet cream with cream to be churned less than twelve hours before churning. (The cream is ripened in one vessel which holds the cream for a whole churning);

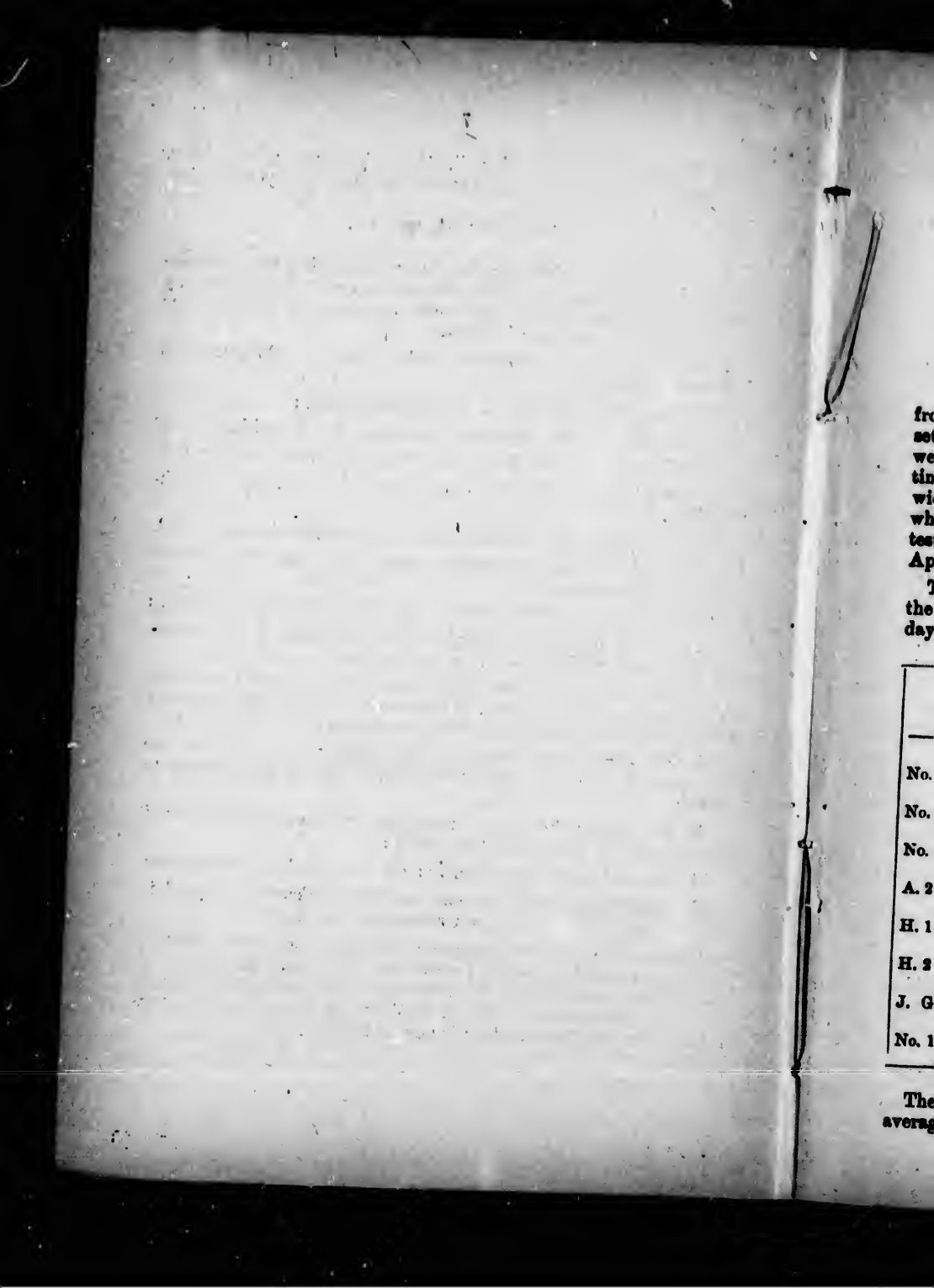
12. Nor add scalding water to the cream; nor guess at the temperature with the finger; nor take two or three hours to churn;

13. Nor gather the butter until the "dasher stands on top," and then dip it out of the buttermilk;

14. Nor add coarse salt by guess; nor work the butter into grease.

15. And finally, we do not send our butter to market wrapped in old rags that may have seen other service in the home.

To those who wish something more extensive than can be presented in a bulletin, we have much pleasure in recommending a pamphlet published by Smallfield & Sons, Renfrew, Ont., costing ten cents; and also a publication by Mrs. E. M. Jones, of Brockville, Ont., costing about twenty cents, which is now in press.



BULLETIN LXXVI.

BUTTER-FAT IN MILK AND CREAM.

VARIATION IN FAT OF MILK FROM THE HERD AND FROM INDIVIDUAL COWS OF THE HERD.

How wide a variation one may expect to find in the fat of milk from individual cows and from a whole herd is a question not yet settled. For over a year we have been testing each of our cows twice a week (morning and evening), some four times a week and some eight times a week. We find that while individual cows may and do vary widely in the per cent. of fat from day to day yet the milk from the whole herd does not exhibit such wide variation in quality—in fact tests made during the month of January, February, March and April show that the per cent. of fat is quite constant.

The following table gives the amounts of fat (per cent.) found in the milk of eight cows, morning and evening as determined in eight days:

		Jan. 11.	Jan. 27.	Jan. 28.	Jan. 29.	Feb. 19.	Feb. 20.	Feb. 29.	Mar. 8.
No. 2 ..	Morning	5.3	4.0	4.6	4.6	3.8	3.5	4.2	4.1
	Evening	4.2	4.8	4.5	3.9	4.4	.....	5.0	4.2
No. 4 ..	Morning	3.8	4.2	4.4	4.4	3.5	3.2	3.8	3.7
	Evening	3.2	4.6	4.2	4.3	4.4	....	4.5	4.2
No. 6 ..	Morning	3.5	3.9	4.0	4.0	3.6	3.4	3.5	3.5
	Evening	3.5	4.0	4.0	3.7	3.8	.....	3.8	3.4
A. 2....	Morning	2.5	3.0	3.7	3.3	.....	3.1	3.5	3.0
	Evening	3.6	3.8	4.0	4.2	4.6	.....	3.5	3.1
H. 1 ...	Morning	2.7	2.9	3.2	3.0	.....	3.2	.....	.....
	Evening	2.6	3.5	2.8	2.5	3.6	.....	.....	.....
H. 2 ...	Morning	2.8	3.0	3.0	3.0	.....	2.8	3.2	3.1
	Evening	3.1	3.0	3.2	2.6	3.2	.....	3.2	3.0
J. G. 1.	Morning	2.8	4.5	4.8	4.6	.....	4.0	4.0	4.1
	Evening	4.2	4.8	4.9	4.4	4.8	.....	4.4	3.7
No. 13 .	Morning	2.3	4.0	4.6	4.4	.....	.....	....	.....
	Evening	4.8	5.3	4.6	4.4	.. ..	.....	.....	.....

The following statement gives the highest, the lowest and the average per cent. of fat found in *the mixed milk from the whole herd*

tested during the months of January, February, March and April. For a part of the time the fat was determined separately in the morning and evening milk, and in sixteen tests made in March the mixed milk of morning and evening was used.

——	Highest.	Lowest.	Average.
Morning milk, 43 trials	3.90	3.05	3.53
Evening milk, 25 trials	4.15	3.40	3.63
Morning and evening milk mixed, 16 trials	3.90	3.30	3.60

From this statement it appears that the widest variation in the morning milk during 43 trials was 0.85 per cent., in the evening milk during 25 trials 0.75 per cent., and in the combined morning and evening milk during 16 trials 0.60 per cent.

Total Solids in Milk Estimated from the Per Cent. of Fat and the Lactometer Reading.

With our present short methods of determining the fat of milk, this part of dairy work has become comparatively easy. In cases where it is thought advisable to determine the solids not fat in the milk as well as the fat, it may be done approximately by the use of the Quevenne Lactometer (together with the fat per cent.) by the following formula recommended by Dr. Babcock:

$$\text{Solids not fat} = \frac{L + 0.7F}{3.8}$$

$$\text{Total Solids} = \frac{L + 0.7F}{3.8} + F.$$

L is lacometer reading at 60° F.
F is the per cent. of fat.

A shorter rule which will give approximately the same results is to add the per cent. of fat to the lactometer reading and divide by 4—this gives the solids not fat. The total solids are then found, of course, simply by adding together the fat and the solids not fat.

Comparing results obtained by the use of this formula with those

obtained by chemical analysis, we have found the following results in the milk from six cows, the average of the trials of each cow being given:

——	Cow No. 2.	No. 4.	A. No. 2.	H. No. 2.	No. 13.	A. No. 3.	Average.
No. of trials	5	7	7	7	6	7	39
Lactometer reading	30.6	33.3	32.62	31.96	31.76	33.10	32.22
Fat according to Babcock test.	4.14	3.86	3.34	2.89	3.22	3.86	3.55
Solids not fat by formula	8.77	9.48	9.20	8.94	8.83	9.41	9.11
Solids not fat by chem. analy's	8.20	9.37	9.10	8.72	8.53	8.98	8.83
Total solids by formula	12.91	13.34	[illegible]	11.83	12.05	13.27	12.66
Total solids by chem. analysis	12.43	13.23	[illegible]	11.61	11.75	12.84	12.38
Difference between formula and analysis	0.48	0.11	0.10	0.22	0.30	0.43	0.26

The average difference in the thirty-nine samples between the total solids as determined by the formula and by chemical analysis was only *0.26 of one per cent.*, almost within the limits of error. This method promises to prove of value in ordinary experimental work or in the rapid analysis of milk, as thereby we may obtain approximately the per cent. of water, of fat, of solids not fat, and of total solids, in a few minutes and at small cost.

Pay for Milk according to per cent. of fat.

Quality is of more importance than quantity in nearly everything Quality or per cent. of fat is what the butter-maker desires most of all in the milk designed for the manufacture of butter, because butter is largely composed of fat—about 84 per cent. Therefore the fat in milk is an index of its value for butter.

It is also a proper basis on which to value milk for cheese-making, because—

1. The serum or pure skim-milk is worth only from 15 to 20 cents per 100 pounds, while the fat is worth from 15 to 30 cents per pound whether in cheese or in butter.
2. The casein or curd is fairly constant in all milk, while the fat varies widely in different samples.
3. The richer the milk in fat up to a certain limit the more pounds of cheese may be made from a given number of pounds of milk.
4. This method will give to each patron more nearly what is just than any other system that has yet been tried, besides taking away all temptation to tamper with milk designed for the manufacture of cheese or butter.

Testing Milk.

The testing of each patron's milk involves considerable labor; hence, we should study how to lessen the labor as much as possible. A device which we have used in the dairy building here for over a year makes the work of measuring and adding the acid very slight. A gallon bottle is kept full of acid. This bottle has an ordinary cork containing three openings—one for a glass syphon having a glass stop-cock, one for a glass funnel, and one small opening to allow the air to escape when the bottle is filled with acid. Such a bottle and syphon has been in use for about fifteen months and requires no attention, neither has it given any trouble or needed repair. With two acid measures, one of which is filling while the acid from the other is being poured into the test bottle containing the milk, the work proceeds very rapidly.

Several inquiries have been made as to the cause of "curdy, crumbly matter" in connection with the fat when making tests with the Babcock tester. The causes are, I think, two:

1. Insufficient mixing of the acid and milk, or in some cases the acid is too weak.

2. Not keeping the bottles properly cleaned. If these become greasy they should be washed with soap-suds or sal-soda water. A small brush should be used for cleaning the neck of the bottle.

Testing Whey.

Every cheese-maker should test the whey each day from the vats, and thus check any losses of fat from this source. The drippings from the cheese ought also to be tested, as frequently there is considerable loss of valuable constituents by improper handling and pressing.

To test whey take the same amount as for new milk (17.6 c.c.), but only half the usual quantity of acid; or better still, get bottles which are specially made for testing whey and skim-milk. These bottles require twice the ordinary quantity of whey or skim-milk, and the ordinary quantity (17.5 c.c.) of acid.

Keeping Whey and Skim-milk sweet.

A question was asked of us recently: "Can skim-milk be treated so as to keep sweet for twenty-four hours?"

The answer was, yes, both whey and skim-milk may be kept sweet twenty-four hours in the hottest weather by heating to 150° or 160° Fahrenheit. This treatment kills the germs which cause the souring of milk and milk products. Most factories have steam, and the cost

of heating the bye-products to a sufficiently high temperature to preserve them sweet would cost very little.

It has been demonstrated that *sweet* whey for feeding hogs is worth from eight to ten cents per hundred pounds compared with middlings and corn. What sour, stinking whey is worth has never been shown. We doubt whether it more than pays for the labor of hauling it to the farm and the feeding of it to the only class of animals that can thrive on it at all.

The Fat of Cream.

The present system of distributing proceeds to patrons of both cheese factories and creameries is causing distrust in the minds of operators and patrons. That it does not do justice in a cheese factory is conceded by nearly all. That the paying for milk according to quality or on its fat basis is much more just is also pretty well established. That the fat basis is the proper one to adopt at a centrifugal or separator creamery none deny. Whether the test for fat, or the Babcock test, is likely to supplant the "oil test" in cream-gathering creameries is a query among creamery men at present. A leading firm sent the following to this department recently: "We have had several inquiries with regard to the practicability of applying the Babcock tester with the bottles made to test cream, and we have been asked our opinion as to whether this will answer for factories which are working on the cream-gathering principle. We have the bottles, which will show twenty-five per cent. of butter fat, and we suppose they can be made to go still higher. What is your opinion about this matter? Do you think that the Babcock with these cream bottles can be made to take the place of the oil-test churn?"

In testing cream the following points require attention:

1. It is difficult to sample sour, thick cream properly. In this case it is best to dilute it with an equal volume of water and multiply the readings by two. For cream containing over twenty-five per cent. of fat a bottle with a detachable neck reading to thirty-six per cent. of fat may be used (for description see Maine Report, Part II., 1891), or the sample may be divided into two bottles.

2. Sweet cream raised by cold, deep setting process may be sampled without difficulty. The pipette should be rinsed into the test bottle with a small amount of water.

3. The cream bottles cannot be used in one of our machines which has swinging pockets, but can be used in another in which the pockets are stationary.

4. In adding hot water after the whirling, care should be exercised that the bottom of the column of fat does not come in the bulb, which is not graduated.

5. If creameries adopt this plan great care should be observed in taking the samples that they may be fair representatives of the whole of the cream.

6. This test gives the *absolute* amount of fat in the cream, and judging from the trials previously noted we may expect more pounds of butter than there are pounds of fat in the cream.

We have made several determinations (by the Babcock method) of the fat contained in cream, with the following results: In testing cream a pipette measuring 18 c.c. is required. The bottles we use are graduated to read up to 25 per cent. of fat. The neck has a bulb and the same amount of acid is used as for whole milk.

Date.	Per cent. fat in cream.	Total lb. fat in cream.	lb. butter yielded.	lb. fat for one lb. butter.	Per cent. of fat in buttermilk.
May 18	18.9	9.64	10.25	0.94	.....
" 21	18.1	4.98	5.50	0.91	0.10
" 21	17.2	3.10	3.60	0.86	0.10
" 23	20.0	3.49	3.40	1.03	.....
" 26	20.6	16.10	20.20	0.79	.....
" 28	27.2	9.52	12.00	0.79	.....
" 28	16.6	4.15	5.50	0.76	0.10
" 28	15.0	4.28	5.50	0.78	0.10
June 4	14.6	2.34	3.00	0.77	0.05
" 4	17.0	4.08	4.90	0.83	0.20
	18.2	3.09	3.60	0.86	.....
Average	18.5	5.89	7.04	0.84	.....

To divide the cash proceeds at a creamery the following plan may be followed:

A delivers 500 lb. cream containing 25 per cent. fat, or 125 lb. fat.
B " 600 " " 20 " 120 "
C " 400 " " 15 " 60 "

Total delivery is 305 "

Sale of butter gives 350 lb. at 20c. or $70.

The net value of each pound of fat delivered therefore is $70 divided by 305 or 22.95 cents.

Therefore—

A's share is 22.95 × 125 or $28.68
B's " 22.95 × 120 " 27.54
C's " 22.95 × 60 " 13.77

Total divided, $69 99